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Responses of Degraded Tibetan Kobresia Pastures to N Addition

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Abstract

© 2017 John Wiley & Sons, Ltd. Kobresia pastures on the Tibetan Plateau are the largest alpine pastoral ecosystems. Kobresia pastures have experienced severe degradation in recent decades, inducing large nitrogen (N) losses from these ecosystems. This is particularly problematic, as it intensifies prevailing N limitation in these regions. Simultaneously, anthropogenic N deposition has increased across these ecosystems, but the fate of added N on variously degraded Kobresia pastures remains unclear. Kobresia pastures of three degradation stages were investigated: living, dying and dead root mats. High and very low (as a tracer) amounts of 15 N-labelled ammonium nitrate (NH 4 NO 3) were applied to root mats under controlled conditions. Leaching was simulated over 3 months, and 15 N recovery was measured in the plant-soil system. N addition promoted aboveground biomass and foliar N content of Kobresia during the early growth period, indicating a short-term offset of N limitation. After 7-8 weeks, plant growth and 15 N uptake were reduced in plants with initial N addition, reflecting a transition to N limitation induced by N uptake and leaching from soil. This limitation was also indicated by the strong decline of NO 3 - in leachates from living root mats compared with degraded root mats. Leaching N losses from dying and dead root mats increased 22 and 63 times, respectively, compared with those of living root mats. We conclude that N addition can facilitate plant growth in living root mats but contributes to N leaching in degraded pastures. This contribution to N leaching may weaken ecosystem recovery, increase NO 3 - loading of adjacent lower landscape parts and cause eutrophication of aquatic ecosystems.

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Keywords

15 N labelling, N loss, NO leaching 3 -, Pasture degradation, Tibetan Plateau